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THE ORIGIN OF THE EGYPTIAN CALENDAR

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Probably no calendaric institution has continued over a longer period than the Egyptian calendar. After its uninterrupted use during all of Egyptian history, the Hellenistic astronomers adopted the Egyptian year for their calculations. Ptolemy based all his tables in the *Almagest* on Egyptian years; even as late as A.D. 1543 Copernicus in *De revolutionibus orbium cœlestium* used Egyptian years. The explanation of this fact is very simple: astronomers are practical-minded people who do not connect more or less mystical feelings with the calendar, as the layman frequently does, but who consider calendaric units such as years, months, and days as nothing but conventional units for measuring time. And because *the* main requirement of every measuring unit is, of course, its constancy, the Egyptian calendar is an ideal tool: twelve months of thirty days each, five additional days at the end, and no intercalation whatsoever. It is no wonder that the Hellenistic astronomers preferred this system to the Babylonian lunar calendar with its very irregularly changing months of twenty-nine and thirty days combined with a complicated cyclic intercalation—not to mention the chaos of Greek and Roman calendars.[1]

The ideal simplicity of the Egyptian calendar, however, raises serious problems for the historian. Should we assume that astronomers, for the sake of their own calculations, imposed on the rest of the population a calendar with no respect for sun and moon? No scholar will accept this viewpoint, even if he does not hesitate to speak (in cases of no consequence) of Egyptian "astronomers" or Egyptian *Kalendermacher*. Only one other solution seems to remain: the simplicity of the Egyptian calendar is a sign of its primitivity; it is the remainder of prehistoric crudeness, preserved without change by the

[1] It may be remarked that for the same reason modern astronomy does not use the Gregorian calendar for computations but Julian years instead (the continued use of Egyptian years would be inconvenient because of the discrepancy of about one and a half years with the adopted historical chronology of our times).

Egyptians, who are considered to be the most conservative race known in human history.

Even this second solution, however, is by no means satisfactory. I do not have in mind the sophisticated argument that one of the strongest foundations for the belief in the extreme Egyptian conservatism is the very maintenance of the calendar and should therefore not be used as an *explanation* of the calendar. What I mean is the fact that there is no astronomical phenomenon which possibly could impress on the mind of a primitive observer that a lunar month lasts 30 days and a solar year contains 365 days. Observation during one year is sufficient to convince anybody that in about six cases out of twelve the moon repeats all its phases in only 29 days and never in more than 30; and forty years' observation of the sun (e.g., of the dates of the equinoxes) must make it obvious that the years fell short by 10 days! The inevitable consequence of these facts is, it seems to me, that *every theory of the origin of the Egyptian calendar which assumes an astronomical foundation is doomed to failure.*

Four years ago I tried to develop the consequences of this conviction as far as the Egyptian *years* are concerned. I showed[2] that a simple recording of the extremely variable dates of the inundations leads necessarily to an average interval of 365 days. Only after two or three centuries could this "Nile calendar" no longer be considered as correct, and consequently one was forced to adopt a new criterion for the flood, which happened to be the reappearance of the star Sothis. I do not want to repeat the discussion here, but I should like to state that I still think that this theory is in perfect agreement with the structure of the Egyptian calendar, which has only three seasons, admittedly agricultural and not astronomical, and which has no reference to Sothis at all.[3] I did not see, at that time, any satisfactory

[2] O. Neugebauer, "Die Bedeutungslosigkeit der Sothisperiode für die ältere aegyptische Chronologie," *Acta orientalia*, XVII (1938), 169–95.

[3] I wish to take this opportunity to make some remarks about an interesting paper by H. E. Winlock, "The Origin of the Egyptian Calendar" (*Proceedings of the American Philosophical Society*, LXXXIII [1940], 447–64), where the problem of the Egyptian year is treated independently of my paper.

The most important point seems to me that Winlock reached the same conclusion, namely: the classical theory that *both* Nile and Sothis are responsible for the beginning of the years must be abandoned. The old story of the "creation" of the Egyptian calendar in 4231 B.C. can now be considered as definitely liquidated. An objection has been raised against my theory of a "Nile-year" resulting from averaging the strongly fluctuating

explanation of the second characteristic element of the Egyptian calendar—the *months* of invariably 30 days' length. How are we to explain these artificial months, seemingly so contradictory to all our experience with ancient calendaric systems?

The solution which I finally believe to have found for this problem is nothing but the radical abandoning of the concept that the 30-day months should be explained by some kind of primitive astronomy and the clear insight into the fact that the 30-day months are by no means peculiar to Egypt but play a very important role also in Mesopotamia, the classical country of the strictly lunar calendar.

I can best start by quoting two sentences from Sethe's *Zeitrechnung:* "Bei den Aegyptern haben sowohl Lepsius als Ed. Meyer und Andere die Existenz eines Mondjahres für die Urzeit als a priori selbstverständlich vorausgesetzt . . . . und Brugsch wollte sogar das Fortbestehen eines solchen Mondjahres in geschichtlicher Zeit neben dem Siriuswandeljahr aus zahlreichen Angaben über Mondstände

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intervals between the inundations. This objection is that there is no proof of the existence of "Nilometers" at so early a period (*ibid.*, p. 450, n. 11). However, no precise Nilometer is required for my theory. The sole requirement is that somebody recorded the date when the Nile was clearly rising. As a matter of fact, *every* phenomenon which occurs only once a year leads to the same average, no matter how inaccurately the date of the phenomenon might be defined. The averaging process of a few years will automatically eliminate all individual fluctuations and inaccuracies and result in a year of 365 days. Fractions, however, would be obtained only by much more extensive recording and by accurate calculation. The actual averaging must, however, be imagined as a very simple process based on the primitive counting methods as reflected in the Egyptian number signs: the elapse of one, two, or three days recorded by one, two, or three strokes. After ten strokes are accumulated, they are replaced by a ten-sign, thereafter ten ten-signs by a hundred symbol, etc. This is the well-known method of all Egyptian calculations. This method finally reduces the process of averaging to the equal distribution of the few marks which are beyond, say, three hundred-signs and five ten-signs; in other words, there is no "calculation" at all involved in determining the average length of the Nile-years. Of course, we need not even assume the process of counting all the single days every year: the averaging of the excess number of days over any interval of constant length (say twelve lunar months) gives the same result. This equal distribution of counting-marks finally makes it clear that no fractions will be the result of the process.

Winlock's own theory assumes the prediction of the flood at an early epoch according to lunar months (pp. 454 ff.). Thereafter, Menes is credited with having begun to determine the beginning of the years by observing the Sothis star (pp. 457–58), the seasons still being of variable length because of their composition by lunar months (p. 459). Finally, Djoser around 2773 B.C. is supposed to have dropped the actual New Year's observations by installing the year of "12 times 30 +5 days" because "experience of centuries by now had seemed to show that the year should contain 365 days" (p. 462). I cannot see how *experience* from observing Sothis could have created this assumption of the length of the year because Sothis after one hundred years of 365 days each rises 25 days too late! This obvious *contradiction* between the year of 365 days and any astronomical observations seems to me just the most striking argument in favor of looking for another phenomenon which leads to a 365-day year—the flood of the Nile.

. . . . schliessen."[4] But, he goes on, "schwer liesse sich von einem solchen alten Mondjahre die Brücke zu dem geschichtlichen Wandeljahre . . . . schlagen." This conclusion of Sethe is obviously the generally accepted viewpoint. However, how can one justify the total ignoring of the textual evidence amply collected, for example, by Brugsch in his *Thesaurus*,[5] which shows clearly a great interest in the real lunar months? Indeed, Brugsch's assumption of the existence of real lunar months has only been confirmed since his time.[6] I admit, of course, that Borchardt[7] overemphasized the importance of the full-moon festivals for the coronation ceremonies and that his chronological construction, based on this theory, requires checking. The fact remains, however, that at all periods of Egyptian history the real lunar months had their well-defined religious significance. One need only recall the countless passages where we are told about the loss and restitution of the moon's eye, of its magical importance, etc. Indeed, one should be surprised that the behavior of the real moon should have been totally disregarded and have been replaced by meaningless intervals of 30 days. Moreover, we now know that the "short" and "long" years mentioned in the list of offerings at Beni-hasan[8] (Twelfth Dynasty) are the years containing either twelve or thirteen lunar festivals (say, new moons), respectively; this is shown by a Demotic papyrus in which a simple cycle of twenty-five years is developed according to which one can tell whether a certain year contains twelve or thirteen new moons and on what dates in the civil calendar they can be expected.[9] In other words, we have to admit the *coexistence* of real lunar months and of the civil calendar with its 30-day months. Sethe's contradiction then disappears, and we no longer need astronomy to explain the 30-day months: all "astro-

[4] K. Sethe, *Die Zeitrechnung der alten Aegypter* ("Nachr. Ges. Wiss. Göttingen, Phil.-hist. Kl.," 1919, pp. 287–320, and 1920, pp. 28–55, 97–141), pp. 300 and 301.

[5] H. Brugsch, *Thesaurus inscriptionum aegyptiacarum*, Vol. I: *Astronomische und astrologische Inschriften altaegyptischer Denkmäler* (Leipzig, 1883).

[6] Winlock, *op. cit.*, pp. 454 f.

[7] L. Borchardt, *Die Mittel zur zeitlichen Festlegung von Punkten der ägyptischen Geschichte und ihre Anwendung* (Cairo, 1935).

[8] *Urkunden d. aeg. Altertums*, VII, 29, 18=P. E. Newberry, *Beni Hasan I*, p. 25, ll. 90 f.

[9] Neugebauer-Volten, "Untersuchungen z. antiken Astronomie. IV: Ein demotischer astronomischer Papyrus (Pap. Carlsberg 9)," *Quellen u. Studien z. Gesch. d. Mathematik*, Abtl. B, IV (1938), 383–406.

nomical" interest is restricted to the actual observation of the real moon with no resultant influence on the civil calendar.

But how are we to explain the coexistence of the schematic 30-day months side by side with the real lunar months? The answer sounds paradoxical at first but is actually very simple: *schematic months are the natural consequence of a real lunar calendar.*

Here the analogy with the situation in Mesopotamia enters the picture. The actual behavior of the moon is so complicated that not before the very last centuries of Babylonian history was a satisfactory treatment of the movement of the sun and the moon developed sufficiently accurate to predict the length of the lunar months for an appreciable time in the future. In other words, only a highly developed theoretical astronomy (today we would say "only celestial mechanics") is able to determine the further course of a lunar calendar. Private and public economy require the possibility of determining future dates regardless of the irregularity of the moon and the inability of the astronomers to predict the outcome. A simplified calendar is equally useful also for the past because it eliminates the necessity of keeping exact records of the actual length of each month. It is amply testified from Babylonian sources how this natural demand was met: beside the real lunar calendar there was a schematic calendar of twelve months of 30 days each, regardless of the real moon. A few well-known examples are sufficient to prove this statement: contracts for future delivery were dated in this schematic calendar, regardless of the actual outcome in the particular year,[10] past expenses[11] and rents are calculated according to a 360-day business year and to 30-day months,[12] etc. But it is interesting to see that this schematic year was also in use in astronomical texts. Solstices and equinoxes are listed as falling on the fifteenth of the Months I, IV, VII, and X, although everybody knew that the dates in the real lunar calendar would be totally different in almost all cases. The same holds with

[10] Thureau-Dangin, *RA*, XXIV (1927), 188 ff. These examples belong to the Old Babylonian, Persian, and Neo-Babylonian periods.

[11] Kugler, *ZA*, XXII (1908), 74 f.

[12] Neugebauer, *Mathem. Keilschrift-Texte*, III, 63.

the lengths of day and night,[13] the shadow length,[14] rising and setting of fixed stars,[15] etc.[16] This use of the schematic calendar in an astronomical context is especially important; it demonstrates clearly that the schematic dates do not represent an attempt to approximate as closely as possible the real facts but merely constitute a way of expressing future dates in round numbers according to a general scheme whose exact relation to the real lunar calendar remains to be established later on when actually needed.

It is evident that the analogous situation in Egypt is sufficient to explain analogous consequences. No one was able to predict exactly the moon's behavior, and a schematic calendar was therefore quite necessary wherever economic life demanded regularity and simplicity. "The" Egyptian calendar is therefore in all respects the result of practical needs alone, and "astronomy" is restricted to the simple fact that the real lunar festivals were regulated by direct observation, with no attempt to influence the civil calendar, and vice versa. It is only a slight difference in emphasis which brought about the almost total eclipse of the schematic calendar in Babylonia and of the lunar calendar in Egypt. The deeper reasons for this difference in emphasis can perhaps be found in the difference of social and economic structure of the two countries. In unified Egypt with its centralized administrative system the schematic calendar naturally had a much higher importance for the life of the whole country[17] than in the

[13] E.g., Weissbach, "Bab. Miscellen," *Wiss. Veröff. DOG*, IV (1903), 50 f., and Kugler, *Sternkunde*, Ergänzungsheft, 88 ff.

[14] Weidner, *AJSL*, XL (1924), 186 ff.

[15] CT, XXXIII, 1–8.

[16] It is very possible that many dates in cuneiform sources are actually meant in the schematic calendar, but we have no means to prove it. It would be, however, equally difficult to prove that the real lunar calendar is meant.

[17] When I reviewed the content of this paper at the meeting of the American Oriental Society in Boston, Professor H. Frankfort asked whether the institution of the schematic calendar could be assumed to belong to the reign of Djoser. I think that no serious objection can be raised against such an assumption, because the only condition for the creation of the schematic calendar is a sufficiently well-organized and developed economic life. On the other hand, means to determine such a date by *astronomical* considerations do not exist.

The problem of the invention of the schematic months must not be confused with the problem of the period at which the 365-day year was introduced. The two institutions are absolutely independent—at least in principle. The 365-day year must have been created

city-states of early Mesopotamia, where each community enjoyed the right of having a calendar of its own.[18]

It is worth noticing that the parallelism between the Babylonian and Egyptian situation also holds for the astronomical documents which we possess from the Twelfth Dynasty and from the New Kingdom. The decanal lists in the coffins from Asyut[19] represent the same type of schematic astronomical calendars as do the Babylonian texts,[20] and the same holds for the star calendars around the figure of Nut in the cenotaph of Seti I and in the tomb of Ramesses IV.[21] Here again, as in Babylonia, we see that astronomy in its earlier stages of development makes no attempt to give exact dates but applies simple schemes which strongly idealize the real facts.[22]

To summarize, both the Egyptian and the Babylonian calendaric concepts display a higher complexity than usually admitted by modern scholars. One point needs special stressing: this complexity must not be considered as the struggle of two or three competing calendaric systems in the modern sense of the word but represents the peaceful coexistence of different methods of defining time moments and time intervals in different ways on different occasions. The situation is here very much the same as in ancient metrology: no need is felt to measure, e.g., grain and silver and fishes by the same units of

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at a period when the inundation coincided roughly with the season called "inundation." Such a coincidence held for the centuries around 4200 and again in the centuries around 2800. The latter date (i.e., the time of Djoser) has been considered by Winlock (*op. cit.* p. 462) as the date of the definite establishment of the Egyptian year. The analysis of all available evidence for the use of the 365-day year by A. Scharff (e.g., *Historische Zeitschrift*, CLXI [1939], 3–32) also shows that there is no reason to maintain the earlier date (as I was still inclined to do in my paper in *Acta orientalia*).

[18] Cf., e.g., N. Schneider, "Die Zeitbestimmungen der Wirtschaftsurkunden von Ur III," *Anal. Or.*, Vol. XIII (1936).

[19] Cf., e.g., Pogo, *Isis*, XVII (1932), 16–24, and *Osiris*, I (1935), 500–509.

[20] Of course, only as far as the *method* is concerned; the content is totally different.

[21] For the astronomical and mythological interpretation of these texts see Lange-Neugebauer, "Papyrus Carlsberg I", *Kgl. Danske Vidensk. Selsk. Hist.-fil. Skrifter*, Vol. I, No. 2 (1940). It is a methodical mistake to use these documents as astronomically precise and to calculate their date under this assumption—not to mention the fact that there does not yet exist a satisfactory explanation of essential features of the "diagonal calendars" on the coffin lids.

[22] The same can be observed in early Greek astronomy, e.g., in Autolycus (*ca.* 300 B.C.), *De ortibus et occ. II*, theorem 6 (ed. Hultsch, p. 118).

weight, nor is an attempt made to establish well-defined relations between these measures. Exactly in the same sense all modern talk about ancient "luni-solar calendars" constitutes an anachronism: some elements of ancient life are regulated according to the seasons; others, according to the moon (and in Egypt also according to the Nile and Sothis). But no Egyptian thought about a Sothis-lunar calendar or any analogous construction. The key to understanding the origin of the Egyptian calendar seems to me to be the insight into the *independence* of all its elements which we still see in existence in historical times: the Nile, the Sothis star, the fiscal calendar, and the moon.

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